WHAT IS CLAIMED IS:

1. A method of material surface treatment in a substantially downstream position of a plasma source, the method comprising generating a plasma discharge including a gas-C, the gas-C comprising a Gas-A molecule containing essentially hydrogen as an element and a Gas-B containing essentially a halogen and/or a halide; wherein said plasma discharge is substantially free from an oxygen bearing species.

2. The method of claim 1 further comprising injecting a Gas-D in the downstream of the plasma of Gas-C and setting objective surface in downstream of the Gas-D injection.

3. The method of claim 1, wherein using the molecule and/or compound of chlorine, bromine and/or iodine as Gas-B.

4. The method of claim 2, wherein using the molecule and/or compound of chlorine, bromine and/or iodine as Gas-B.

5. The method of claim 4, wherein using the molecule and/or compound of chlorine, bromine and/or iodine as Gas-B does not containing oxygen atom.

6. The method of claim 5, wherein using the molecule of chlorine, hydrogen chloride, bromine, or hydrogen bromide as Gas-B.

7. The method of claim 5, wherein using the molecule of chlorine, hydrogen chloride, bromine, or hydrogen bromide as Gas-B.

8. The method of claim 6, wherein the flow rate of the molecule of hydrogen-chloride or hydrogen-bromide as Gas-B in total Gas-C flow is defined as the ratio of amount of hydrogen atom in Gas-B to that in Gas-A is larger than 1/480.

9. The method of claim 2, wherein gas containing silicon as its element is used as Gas-D.

10. The method of claim 2, wherein gas containing carbon as its element is used as Gas-D.

1 11. The method of claim 2, wherein gas containing fluorine as its
2 element is used as Gas-D.

1 12. An apparatus for treating material surface downstream of a plasma
2 source, the apparatus comprising:
3 a treatment chamber;
4 a plasma discharge area to generate a plasma comprising a mixture of a
5 gas composed of molecules containing hydrogen atom as an element and a gas containing
6 molecules and/or compound of chlorine, bromine, and/or iodine, the plasma discharge
7 connecting with the treatment chamber, the treatment chamber being downstream from
8 the plasma discharge area and the treatment area being maintained in a vacuum;
9 a stage for setting an object in the treatment area; and
10 an inner wall surface of the discharged area, the inner wall surface
11 comprising a silicon nitride material.

1 13. The apparatus in claim 11, wherein the at least a gas inlet is set
2 between the plasma discharge area and the upstream of the stage.

1 14. The apparatus in claim 11, wherein at least a part of the plasma
2 discharge area is composed of silicon nitride or quartz whose surface exposed to the
3 plasma is covered by silicon nitride.

1 15. The apparatus in claim 12, wherein at least a part of the plasma
2 discharge area is composed of silicon nitride or quartz whose surface exposed to the
3 plasma is covered by silicon nitride.

1 16. An apparatus for treating a silicon wafer, the apparatus comprising:
2 a code directed to transferring a silicon wafer comprising an upper surface
3 in a vacuum chamber using a transferring means, the silicon wafer including a layer of
4 native oxide overlying the upper surface of the silicon wafer;
5 a code directed to switching a controller for applying a gaseous plasma
6 discharge on the layer of native oxide to substantially remove the native oxide without
7 physically damaging the surface of the silicon wafer;
8 wherein the gaseous plasma discharge is derived from an upstream plasma
9 source from the vacuum chamber, said upstream source comprising a hydrogen bearing

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10 species and a halogen bearing species; wherein the upstream plasma source being
11 substantially free from an oxygen bearing species.

1 17. The apparatus of claim 16 wherein the gaseous plasma discharge is
2 substantially free from an oxygen bearing species.

1 18. The apparatus of claim 16 wherein the silicon wafer is disposed on
2 a stage, the stage being surrounded by an inner surface coated with a silicon nitride
3 compound.

1 19. The apparatus of claim 16 wherein the upstream plasma source and
2 the stage is positioned to each other to substantially eliminate any physical influence of
3 the gaseous plasma discharge.

1 20. The apparatus of claim 19 wherein the gaseous plasma discharge is
2 maintained in a silicon nitride material in the vacuum chamber.

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